

SCIENCE

And Technology Program



Arlin Super and Curt Hartzell

FY 1999 - FY 2001

A Precipitation Accumulation Algorithm (PAA) is needed that provides accurate estimates of rainfall over watersheds that feed Reclamation's reservoirs and managed river basins. This study will develop an algorithm which is a generalized version of Reclamation's Snow Accumulation Algorithm (SAA) developed over the past few years for use with NEXRAD radars.

More than 140 new NEXRAD Doppler weather radars have been installed across the U.S. in recent years to provide for a variety of forecast needs. Because the National Weather Service (NWS) needs to merge or mosaic observations from adjoining radars across the entire nation, a single standard precipitation algorithm (PPS for Precipitation Processing Subsystem) is currently used by all radars during all seasons. This "lock-step" approach does not allow for the maximum use of individual radar observations, especially over portions of the total area scanned by the radar (e.g., drainage basins). The recently developed PAA can be customized for individual drainage basins, irrigation projects, etc., so that more accurate rainfall accumulations can be estimated for specific areas of interest. At least as important, the PAA needs to be made available in near real-time at individual field sites so water managers have ready access to the rainfall estimates, both as text information and color displays. Future work should use these estimates as input to runoff models so that streamflow may be predicted from radar rainfall observations.

The overall goal of this project is to improve and extend the application of the SAA to rainfall under warm conditions. The project objectives for FY 1999 were:

Objective 1. Develop a prototype Precipitation Accumulation Algorithm (PAA) to provide spatial fields over storm total and shorter periods, and provide a means to make PAA estimates over specific watersheds that are of interest to Reclamation's water operations managers. These rainfall estimates are displayed on the Hydrologic Rainfall Analysis Project (HRAP) grid (about 4 km x 4 km cells).

Objective 2. Compare, for a limited number of rain storms, PAA estimates using level II and III reflectivity (Z_e) data to determine the loss of accuracy caused by lower Z_e resolution level III observations.

Objective 3. Compare PAA estimates to rain gauges to estimate relative accuracy and adjust the PAA to fit observed data.

Objective 4. Compare PAA to the standard NOAA Precipitation Processing System (PPS) algorithm to demonstrate improvements.

Objective 5. Continue to develop software to provide Plan-position Indicator (PPI) visual color displays of rainfall accumulation estimates.

Project work on the objectives during FY 1999 was successful and is being implemented for real-time assessment as follows:

SCIENCE

And Technology Program



Objective 1: A PAA has been developed which is a generalized version of Reclamation's Snow Accumulation Algorithm (SAA) developed over the past few years for use with NEXRAD Doppler weather radars. It is being tested under a variety of operational conditions.

Objectives 2-3: Comparisons of precipitation gage measurements with Algorithm estimates based on radar measurements from the Medford, Oregon, mountain-top radar during the 1998-99 winter were completed. Several storms were selected during which the radar viewed typical conditions where snow which melted into rain was observed by gages at elevations well below the radar. A number of variations were attempted using different radar-snow relationships and a range correction scheme. This work was done in support of Curt Hartzell's investigation into the usefulness of NEXRAD radar rain estimates for the AWARDS system. (See Project No. WR.99.04 - AWARDS System Enhancements.) Promising results were presented by Hartzell in a recent workshop cited below and are available in real-time at the NEXRAD web page cited below. Work is continuing on the melting layer effects of the "bright band" that bias NEXRAD PAA estimates.

Objectives 4-5: Work is continuing on these comparisons with standard PPS in conjunction with WR.99.04 in the Rogue and WR.00.07 in the Tualatin Project AWARDS System. PAA results appear more realistic than standard PPS algorithms which often miss observed precipitation. PPI presentations of the precipitation estimates are available on the Internet in quasi real time for use by water operations managers and irrigation districts. Feedback from Reclamation clients in the Bend Field Office and the Rogue and Tualatin Irrigation Districts is positive, and products are being tailored to meet specific needs.

The primary partners on this project during FY 1999 were: NWS Pacific Northwest River Forecast Center, Portland, WFO, Reclamation's Bend Field Office, and three irrigation districts in the Rogue River Basin, Oregon. Additional funding for related applications was provided through NOAA's GEWEX-Continental-scale International Project, Office of Global Programs.

Other RTT projects that enhance this project are:

- Riparian & Agriculture ET Demand Study (WR.99.43), Brower
- Quantitative Precipitation Forecasts (WR.99.07), Stodt
- NEXRAD Snow Accumulation Algorithm (WR.99.09), Super
- AWARDS System Enhancements (WR.99.04), Hartzell

AWARDS system and NEXRAD algorithm products and papers resulting from this study are displayed on Reclamation's NEXRAD World Wide Web page on the Internet (<http://www.usbr.gov/rsmg/nexrad>).

Publications prepared during FY1999 include:

Hartzell, C.L. and A.B. Super. 1999. Development of a WSR-88D-based Rain Accumulation Algorithm for Quantitative Precipitation Estimates over Southwestern Oregon. Presented at Workshop on the Use of the WSR-

SCIENCE

And Technology Program



88D in Quantitative Precipitation Estimations in the Intermountain West.

Hartzell, C.L., L.A. Brower, R.W. Stodt, and S.P. Meyer. 2000. Agricultural Water Resources Decision Support System. Preprints, 2nd Conference on Environmental Applications, Amer. Meteor. Soc., Long Beach, California, paper 5.7, 8 pp.

Hartzell, C.L., and A.B. Super. 2000. Development of a WSR-88D based Snow Accumulation Algorithm for quantitative precipitation estimates over southwestern Oregon. Preprints, 16th Int. Conf. on Interactive Information and Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology, Amer. Meteor. Soc., Long Beach, California, paper 11.1, 4 pp.